1 Description

MCR-f-UI-DC, the programmable MCR frequency transducer, is a module for displaying and converting frequencies up to 120 kHz. On the input side, all common frequency generator signals in 2, 3 and 4-wire technology, and signals from incremental encoders can be collected. The input impulses are evaluated using period measurement and are then output by a processor as an analog voltage or current value to match the measuring range start and end value entered.

In order to achieve as short as possible reaction times, the inputs of the frequency transducer have purposely been designed without a frequency input filter. An automatic measurement range selection function (autorange) ensures that the measured value is always displayed with the optimum resolution. Frequency interferences can, however, lead to too large a division factor being selected for low input frequencies. This in turn can result in an erratic output signal (see "Operation with Disturbed Frequency Input Signals" on page 6).

In order to stabilize fluctuating input values, a filter function has been implemented for conversion into the analog output value. The depth of this filter can be set from 1 to 15 using the membrane keyboard. The optimum filter depth depends on the application.

In addition to the analog output, there is also a PNP transistor switching output with a maximum carrying capacity of 100 mA, for monitoring functions, for example (not short-circuit proof).

Specially for rotational speed measurement, it is possible to both enter the measuring range start and end value in revolutions per minute (RPM), and to observe the revolutions in RPM on the LCD (4-pos. + RPM as unit) during operation.

Make sure you always use the latest documentation. It can be downloaded at www.download.phoenixcontact.com. A conversion table is available on the Internet at www.download.phoenixcontact.com/general/7000_en_00.pdf.

This data sheet is valid for all products listed on the following page.
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3 Ordering Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Order No.</th>
<th>Pcs./Pkt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Frequency Transducer</td>
<td>MCR-f-UI-DC</td>
<td>2814605</td>
<td>1</td>
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</table>

4 Technical Data

<table>
<thead>
<tr>
<th>General Data</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>20…30 V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption (without load)</td>
<td>&lt; 60 mA (without switching output)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission error</td>
<td>&lt; 0.15% of end value (typ. 0.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>&lt; 0.015%/K (typ. 0.01%/K)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test voltage:</td>
<td></td>
<td>1.5 kV, 50 Hz, 1 min.</td>
<td></td>
</tr>
<tr>
<td>Input/power supply</td>
<td></td>
<td>1.5 kV, 50 Hz, 1 min.</td>
<td></td>
</tr>
<tr>
<td>Output/power supply</td>
<td></td>
<td>1.5 kV, 50 Hz, 1 min.</td>
<td></td>
</tr>
<tr>
<td>Protection circuit</td>
<td>Transient protection, polarity protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>-20 °C…65 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation indicator</td>
<td>LC display</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control panel</td>
<td>Membrane keypad with 3 keys and LCD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of connection</td>
<td>Pluggable screw connection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation position/assembly</td>
<td>Any, preferably horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions (W / H / D)</td>
<td>45 mm x 75 mm x 110 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductor cross section</td>
<td>0.2…2.5 mm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of housing</td>
<td>ASA-PC (V0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement Input, Frequency Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency range</td>
<td>0.1 Hz…120 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input sources</td>
<td>PNP transistor outputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor supply</td>
<td>ca. 15 V DC / &lt; 25 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input frequency / peak time / resolution</td>
<td>0.1 Hz…120 kHz / ≤ 32 ms / ≥ 12 Bit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal level</td>
<td>2 Vpp (0.1 Hz…120 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Vpp (8.0 Hz…120 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18 Vpp (1.0 Hz…120 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>max. 30 V (incl. DC voltage)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse length</td>
<td>≥ 1μs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current/Voltage Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input signal</td>
<td>0…10 V / 0…20 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut-off frequency</td>
<td>10 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascent time (10…90%)</td>
<td>25 ms</td>
<td></td>
<td></td>
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</tbody>
</table>
Output

<table>
<thead>
<tr>
<th>Output signal</th>
<th>0…10 V / 10…0 V, 0…5 V / 5…0 V or 0(4)…20 mA / 20…0(4) mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current/voltage</td>
<td>max. 25 mA / 12.5 V</td>
</tr>
<tr>
<td>Load</td>
<td>≤ 500 Ω / ≥ 500 Ω</td>
</tr>
<tr>
<td>Alignment zero point / end value</td>
<td>± 25% / ± 25%</td>
</tr>
<tr>
<td>Switching output</td>
<td>– PNP transistor output, – switches the supply voltage to terminal SW, – can carry a load of 100 mA, – not short-circuit proof</td>
</tr>
</tbody>
</table>

Approval

PHOENIX CONTACT PROCESS CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS 31ZN

Class I Div 2 Groups A, B, C, D

A) This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.
B) Warning - explosion hazard - substitution of components may impair suitability for Class 1, Division 2.
C) Warning - explosion hazard - do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.


Immunity to Interference According to EN 61000-6-2

<table>
<thead>
<tr>
<th>Discharge of static electricity (ESD)</th>
<th>EN 61000-4-2</th>
<th>Criterion B²</th>
<th>8 kV discharge in air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic HF fields</td>
<td>EN 61000-4-3</td>
<td>Criterion A³</td>
<td>6 kV contact discharge</td>
</tr>
<tr>
<td>Fast transients (burst)</td>
<td>EN 61000-4-4</td>
<td>Criterion B²</td>
<td>10 V/m</td>
</tr>
<tr>
<td>Surge voltage capacities (Surge)</td>
<td>EN 61000-4-5</td>
<td>Criterion B²</td>
<td>Input/output/supply: 2 kV / 5 kHz</td>
</tr>
<tr>
<td>Conducted interference</td>
<td>EN 61000-4-6</td>
<td>Criterion A³</td>
<td>Input/output: 2 kV / 42 Ω</td>
</tr>
<tr>
<td>Noise emission of housing</td>
<td>EN 55011⁴</td>
<td>Criterion A⁵</td>
<td>Supply: 1 kV / 2 Ω</td>
</tr>
</tbody>
</table>

Noise Emission According to EN 61000-6-4

| Noise emission of housing | EN 55011⁴ | Criterion A⁵ | 10 V |

¹ EN 61000 corresponds to IEC 61000
² Criterion B: Temporary impairment to operational behavior that is corrected by the device itself.
³ Criterion A: Normal operating behavior within the defined limits.
⁴ EN 55011 corresponds to CISPR11
⁵ Criterion A: Area of application industry
4.1 Dimensions

Figure 1 Dimensions

5 Features

Figure 2 Features of MCR-f-UI-DC
6 Block Diagram

7 Operation with Disturbed Frequency Input Signals

7.1 Measures to Counter External Influences
- Use shielded conductors.
- Lay cables in an appropriate manner (EMC-compliant).
- Connect terminal 4 (GND 1) along the most direct route to PE.

7.2 If Signal Level > 20 V
- Unplug the jumper located in the module after opening the side flap. The jumper can be parked temporarily on one of the three free pins.
- Now route the frequency input signal to the module via terminal 2. The signal is returned via terminal 4 (GND 1).
- No additional settings are necessary.

7.3 If Signal Level > 10 V
- Connect the bottom two pins of the pin strip with the jumper.
- Now route the frequency input signal to the module via terminal 2.
- No additional settings are necessary.

8 Resetting to Delivery State
- Connect the top two pins of the pin strip (nearest display) with the jumper.
- Terminal 2 is now ready again for the connection of NAMUR sensors.
9  Connection Technology

2-wire DC (mechanical contact)

2-wire DC NAMUR sensor

Alternatively, terminal 1 is also possible instead of terminal 6.

3-wire DC with:
PNP transistor output

NPN transistor output

PNP transistor with pull-down resistor

NPN transistor with pull-up resistor

4-wire DC with:
PNP transistor output

NPN transistor output
Incremental encoder with push-pull:

- External supply of signal generator

```
UB = 5-30 V DC
+8.2 V
f IN
GND1
NPN
+15 V
U IN
I IN
```

- Supply of signal generator from the module

```
UB = 15 V/25 mA
+8.2 V
NAMUR
f IN
GND1
NPN
+15 V
U IN
I IN
```

The external supply can also be picked off from terminals 9 +24VDC and 10 GND.

3-way isolation is then no longer provided. The connection from terminal block 4 GND1 to terminal block 10 GND is essential!

Incremental encoder with HTL logic:

- External supply of signal generator

```
UB = 24 V DC
+8.2 V
f IN
GND1
NPN
+15 V
U IN
I IN
```

- Supply of signal generator from the module

```
UB = 15 V/25 mA
+8.2 V
NAMUR
f IN
GND1
NPN
+15 V
U IN
I IN
```

U input (direct current voltage)

```
UB = 0 V DC
```

I input (direct current)

```
```

100240_en_05

PHOENIX CONTACT

8
10 Functions of the Membrane Keypad

Press the key briefly: The output value calculated is displayed.
By pressing the key again, you return to the current input measured value.

Press the key briefly (< 0. sec.): Switches the module to edit mode for frequency input signals.

Press the key for at least 2 seconds: Switches the module to edit mode for analog input signals.

Press the keys briefly together (< 0.5 sec.): Switches the module to extended edit mode.

Press the keys briefly together: Ends edit mode, without saving any settings that may have been made.

Adapts the current setting in edit mode and switches automatically to the next value.

10.1 Special Function of the Keys in Edit Mode

In edit mode for pulse input signals and for analog input signals, pressing the enter key in addition to the + or - key accelerates forward or backward counting.

By releasing the key and then briefly pressing it again, it is possible to carry out fine adjustments.

11 Display on LCD

11.1 Display Within Setting Range

- Frequency input for NAMUR, 2, 3 and 4-wire sensors, incremental encoders with push-pull and HTL output signal and dry contact. Settings can be made in either Hz or RPM/kRPM [Display: kRM] / MRPM [Display: MRM].

- Frequency input for NAMUR sensors with wire break and short-circuit recognition. Settings can be made in either Hz/kHz or RPM/kRPM [Display: kRM] / MRPM [Display: MRM].

- Current input 0...20 mA

- Voltage input 0...10 V

- ON delay of switching output. (setting range 0...30 sec., default value = 0.00 sec.)

- OFF delay of switching output. (setting range 0...30 sec., default value = 0.00 sec.)

- Setting POWER ON delay (switching output) (setting range 0...30 sec., default value = 1.00 sec.) During this period, the switching output does not react to events. This function is only of effect directly after switching on the supply voltage.

- Setting the wire-break detection time (setting range 0.2...10.1 sec., default value = 10.1 sec.)
If no input signal is detected during this period, "No Input" appears on the display and the outputs behave according to their settings.

- Setting the end value (setting range 75...125%, default value = 100%)

- Setting the zero point in relation to the previously set output signal: (setting range -5...+5 mA / -2.5...+2.5 V; default value = 0 mA / 0 V)

- Setting the division factor from 0.1 to 9999 (default value = 1.0). Slow positioning tasks require holed coupling halves with multiple divisions (factor > 1). Measuring the rotational speed of a motor at the gearbox requires a small division factor (factor < 1).
100240_en_05

Setting the filter depth of the analog output when using frequencies as input value (setting range 1...15).

This function can only be configured using the membrane keyboard.

Setting the analog output value if the measuring range is fallen below (setting range 0.00...24.00 mA, or 0.00...12.00 V)

Setting the analog output value if the measuring range is exceeded (setting range 0.00...24.00 mA, or 0.00...12.00 V)

Setting the analog output value with wire break or an input signal that is not available (setting range 0.00...24.00 mA, or 0.00...12.00 V)

Saving. By pressing the key, the set parameters are saved.

By pressing the key, the setting mode is interrupted without saving the parameters set.

By pressing the key, the current settings are overwritten by the default values. The parameters of the frequency input and analog input are unaffected.

11.2 Displaying the Switching Output

If “High Setpoint” is exceeded, the transistor switches to “High”.
If “Low Setpoint” is fallen below, it switches to “Low” (with hysteresis).

If “High Setpoint” is exceeded, the transistor switches to “Low”,
If “Low Setpoint” is fallen below, it switches to “High” (with hysteresis)

If “High Setpoint” is fallen below, the transistor switches to “High”.

If “High Setpoint” is exceeded, the transistor switches to “High”.

Transistor is permanently switched (N/C).
Transistor is permanently switched off (N/O).

Between “Low Setpoint” and “High Setpoint”, the transistor switches to “High”.

If “Low Setpoint” is fallen below, and “High Setpoint” is exceeded, the transistor switches to “High”.

11.3 Messages in Operating Mode

Has fallen below the measuring range.
This message and the current frequency flash alternately if the frequency falls below the bottom measuring range set.

Measuring range exceeded.
This message and the current frequency flash alternately if the frequency exceeds the top measuring range set.

No input signal.
This message flashes for the following reasons:
1. No sensor connected!
2. For NAMUR: a) Short-circuit or b) Wire-break!
3. Short-circuit frequency <-> GND!
4. No input signal found within the wire-break detection time set (l.br.time).

11.4 Menu Guidance

In edit mode, the arrow points to the function to be set.
12 Menu Flowcharts

12.1 Configuration of the Frequency Input – Sequence of Menu

Operating mode

- Press briefly

f-input

Measuring range start

Measuring range end

Analog output

Switching output

Bottom switching point

Top switching point

Saving values

Operating mode

Figure 5 Configuration of the frequency input – sequence of menu
12.2 Configuration of the Analog Input – Sequence of Menu

Operating mode Press for at least 2 seconds

Analog input

Measuring range start

Measuring range end

Analog output

Switching output

Bottom switching point

Top switching point

Saving values

Operating mode

Figure 6 Configuration of the analog input – sequence of menu
12.3 Configuration of the Extended Mode – Sequence of Menu

Operating mode

Press briefly

ON delay

OFF delay

POWER ON delay

Wire break detection

End value

Zero point

Division factor

Output filter function

Continued
Continuation of the Sequence of Menu:

Figure 8 Configuration of the extended mode – sequence of menu (2)
13 Example: Configuration Based on a Frequency Input Signal

The module MCR-f-UI-DC has the following functions:

- **Frequency range**: 5…45700 Hz, 3-wire NPN sensor
- **Output signal**: 4…20 mA
- **Switching behavior**:
  - Bottom switching point ("High" to "Low") at 15 Hz
  - Top switching point ("Low" to "High") at 20 kHz
- **ON delay**: 10 s
- **OFF delay**: 5 s
- **Wire-break detection time**: 1 s

---

**Figure 9** Example: configuration based on a frequency input signal
13.1 Continuation of the Configuration Example:

Operating mode Press briefly -> extended operating mode

ON delay

OFF delay

Wire break detection time

Example

Figure 10 Continuation of the configuration example
14 Configuration Software MCR/PI-CONF-WIN-...

The MCR configuration software is available for the configuration and visualization of all parameters for the MCR-f-UI-DC frequency transducer.


The modules are configured via a serial interface. A label is also created by the software that can be placed on the module.

15 Application Example: Speed Measurement of a Drive

![Diagram of speed measurement of a drive]

NAMUR
Closed state: ≤ 1.2 mA
Open state: ≥ 2.1 mA

Figure 11 Application example: speed measurement of a drive